

WE CLAIM:

1. In a method of making a dual work function gate electrode of a CMOS semiconductor structure, the improvement comprising formation of the dual work function gate electrode so
5 that there is no boron penetration in the channel region and no boron depletion near the gate oxide, comprising:

a) forming a gate oxide layer over a channel of a nMOS site and over a channel of a pMOS site;

b) forming an undoped polysilicon layer over said gate
10 oxide layer;

c) masking said pMOS site, forming an a-Si layer over said nMOS site using a first heavy ion implantation, and implanting arsenic solely into said a-Si layer;

d) masking said nMOS site formed by step c), forming an
15 a-Si layer over said pMOS site using a second heavy ion implantation, and implanting boron solely into said a-Si regions;

e) laser annealing said nMOS and pMOS sites for a sufficient period of time and at an energy level sufficient to
20 melt at least a portion of the a-Si but insufficient to melt the polysilicon; and

f) affecting cooling after laser annealing to convert a-Si into polysilicon without gate oxide damage.

2. The method of claim 1 wherein in step c), said first
25 heavy ion implantation is affected by selecting a material from the group consisting of Ge or Si.

3. The method of claim 2 wherein in step d), said second heavy ion implantation is affected by selecting a material from the group consisting of Ge or Si.

30 4. The method of claim 3 wherein in step e) said pulse time for laser annealing is between about 40 ns to about 80 ns.

5. The method of claim 4 wherein said laser energy level sufficient to melt at least a portion of a- Si but insufficient to melt said polysilicon is between about 0.3 J/cm² to about 0.7 J/cm².

5 6. The method of claim 5 wherein in step d) said boron implanting in said a- Si regions is in a concentration range from about 1 x 10¹⁹ cm⁻³ to about 5 x 10²⁰ cm⁻³.

7. The method of claim 2 wherein said first heavy ion implantation is affected by using Ge.

10 8. The method of claim 2 wherein said first heavy ion implantation is affected using Si.

9. The method of claim 3 wherein said second heavy ion implantation is affected using Ge.

10. The method of claim 3 wherein said second heavy ion implantation is affected using Si.